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CANADA

DEPARTMENT OF MINES

HON. W. A. GORDON, MINISTER; CHARLES CAMSELL, DEPUTY MINISTER

EXPLOSIVES DIVISION

LT.-COL. G. OGILVIE, CHIEF INSPECTOR



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ANNUAL REPORT

OF THE

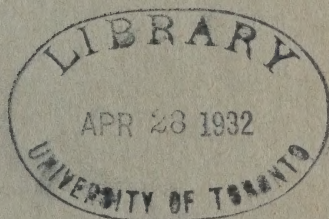
EXPLOSIVES DIVISION

OF THE

DEPARTMENT OF MINES

FOR THE CALENDAR YEAR

1931



OTTAWA  
F. A. ACLAND  
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY  
1932

No. 31





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DEPARTMENT OF MINES  
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**ANNUAL REPORT  
OF THE  
EXPLOSIVES DIVISION OF THE DEPARTMENT OF MINES  
FOR THE CALENDAR YEAR 1931**

BY

Lt.-Col. G. Ogilvie, C.M.G.

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The following report deals with the administration of the Explosives Act during the year ending December 31, 1931.

**STAFF**

On the retirement, on March 31, 1931, of Dr. Alfred E. Macintyre, Chief Explosives Chemist, the maintenance of a chemical section within the division ceased; the vacancy created, in December, 1929, by the appointment of Mr. M. C. Fletcher, formerly Explosives Chemist, to the position of Inspector of Explosives, never having been filled.

The chemical work of the division is now carried out in the Fuel Research Laboratories of the department. Valuable aid has also been rendered by the co-operation of the National Research Council.

**MANUFACTURE OF EXPLOSIVES**

Following on the building, by the T. W. Hand Fireworks Company, Limited, of the factory at Dixie, Ont., that company took over control of the Dominion Fireworks Manufacturing Company, the separate licence for which accordingly lapsed.

This constituted the only change, during the year, in the designation or location of factories licensed to manufacture explosives, a list of which is given in Appendix A.

Inspectors of the Division made 37 visits of inspection to factories and 3 supplementary visits were made by deputy inspectors of the Royal Canadian Mounted Police.

The production of high explosives and black powders (Appendix B, Classes I to III) amounted to approximately 20,842 tons, a decrease of nearly 12 per cent from that of 1930.

**ACCIDENTS IN FACTORIES**

The year under review proved a very unfortunate one in regard to accidents in the conduct of manufacturing operations. Three were attended by fatalities, one causing the death of four employees, while in each of the others one operator lost his life. (1) The first of these occurred in a mixing building in the factory of the Canadian Industries Ltd., at Brownsburg, Que., when on March 23, the operator, Alex. Masson, was instantly killed by an explosion.



Supplies of lead azide and lead styphnate were brought to this building where the charges of one pound of each were weighed into two-pound bags, and these, one at a time, transferred to the "jelly bags" for sieving and mixing. The jelly bags of which there were three, but only two in use, were installed behind shields of  $\frac{3}{8}$ -inch boiler plate, and were operated from an annex behind a reinforced concrete wall 18 inches thick. After mixing, each two-pound charge was removed in turn and placed in a container on the table until a total of eight pounds had been collected for return to the magazine. When these were removed a like quantity of unmixed explosive was brought back to the mixing house.

At the time of the explosion it is computed that there were four pounds of explosive in the jelly bags and 12 or possibly 16 pounds, mixed or unmixed, on the table.

The explosion occurred at 2.15 p.m., fifteen minutes after the foreman had visited the building, and from the observed stage of operations at that time it is reasonable to assume that in the interval Masson had been to the magazine, had returned and had probably completed, or nearly so, weighing the charges preparatory to resuming sieving operations. His body was found between the position of the table and the shields, with both forearms blown off and with evidence of the full effect of the explosion having been received by the body above the hips, his legs being practically uninjured. The wall above the table, which was reduced to matchwood, was pitted, but was not marked below the table level. There were no marks on the floor. The seat of the explosion was evidently on the table. The three light walls of the building were blown out, the radiators blown over but not projected, and damage to other buildings was limited to broken windows in the nearest—a storehouse.

The design of the scale box was such as to preclude the possibility of powder reaching the moving parts. The procedure followed in transferring powder from bag to scales and thence to bag did not leave ground for criticism. The possibility of explosion being initiated by a static discharge, in view of the peculiar susceptibility of styphnate to this hazard, cannot be wholly discarded in spite of the preventative measures taken, such as the wearing of smooth leather shoes on an asphalted concrete floor, the maintenance of a moist atmosphere, the earthing of door handles, the frequent touching of a conveniently placed earth contact by the operator, and testing by electroscope. It seems more probable that the explosion was brought about by some friction inadvertently applied. At the presumed stage in the operation it is very possible that some small spillings of powder were being wiped up, to do which thoroughly it may have been necessary to move the scale box. One can imagine it slipping through fingers wet from handling the cleaning rag kept in a water bucket, or even the box being accidentally knocked sideways. All that is reasonably sure is that the explosion occurred when the operator was working at the bench, and was due probably to friction or to a blow accidentally applied.

It is of interest to note that, while the process followed was in accordance with usual practice, the management has since developed a procedure whereby direct handling of dry explosive is avoided. The charges are weighed wet on suitable trays and these, when dry, are taken to the mixing house and placed on a tilting device, operated from the annex, in front



of the jelly bags. The withdrawal of the bags of mixed powder from the outlet of the jelly bags is also done mechanically. A double jelly bag, doing both sieving and mixing, has been adopted and its use has the additional advantage of practically eliminating dust. Under the new system the maximum quantity of explosive in the building has been reduced to four pounds.

(2) On June 26 an explosion in the "Atlas Mix" house of the Nobel factory of the Canadian Industries Ltd., took toll of four lives. Three of the victims, Messrs. P. Bazilsky, house foreman, E. Schneider, and S. Malcovski, were the men continuously employed in the building, the fourth, Mr. G. Stanyar, was the "dope" house trucker, evidently caught by the explosion as he was leaving the building with a load of empty containers.

The building contained two Atlas mixers one of which was habitually used for the mixing of gelatin powders, and the other for dynamites. At the time of the explosion, which occurred at 9 a.m., there were in the building 322 pounds of nitroglycerine in the nitroglycerine bogie, a charge of 1,400 pounds of 40 per cent Forcite in process of mixing in the gelatin mixer and 800 pounds of Polar Dynamite Mining 40 per cent, being transferred, after mixing, from the dynamite mixer to bogies for conveyance to the cartridging house.

The building was blown to pieces, the passages leading to it wrecked, and the surrounding barricades destroyed. The debris lay mostly in and around the site, but pieces were scattered over a radius of about 200 yards. These included one particularly large piece—a wheel of the dynamite mixer—which was projected, practically intact, to a distance of 200 yards and broke on striking a rock. Other buildings escaped lightly. The galvanized iron roof and top story of the dope house, 200 feet distant, was slightly damaged but none of the five men then in that building was injured beyond temporary shock or being thrown down. The walls of a Hall cartridging house, barricaded and 250 feet distant, were bulged—the near wall being torn slightly outwards at the floor—and the machine thrown out of line. The two men in the building were uninjured. The damage to more distant parts of the factory was limited to broken windows, loosened frames, and the like.

The line foreman had visited the "Atlas Mix" house at 7.05 a.m. and again at 8.20 a.m., and found work proceeding normally. The factory engineer also visited the house about 8.20 a.m., inspected the machines and motors and found all correct. The house foreman reported to him that all was going well. Besides the dope house trucker who was killed, there were, as visiting employees, the nitroglycerine trucker and the cartridge house trucker. It was established that the former left the Atlas house five minutes before the explosion, and the latter entered it three minutes before the explosion, and remained in it about one minute.

From the observations of these men, and the consideration of the regular routine, and the location and condition of the remains of the victims, the stage of operations at the time of the explosion can be closely determined. One man had nearly finished shovelling the finished dynamite charge from the dynamite mixer to the bogies for removal; a second, after assisting with the charging of the gelatin mixer, had withdrawn to the annex to get the smaller ingredients ready for the next charge; and the



third was attending to the operation of the gelatin mixer. The possibility of accidents arising in connexion with the work of the first two was considered but dismissed as highly improbable. Equally improbable was the sudden fracture of a moving part of the machine of the solidity and simplicity in design of the Atlas mixer. The three men were experienced workers and of undoubted reliability. There was no ground for suspicion of carelessness on the part of any.

The mixer had been running for one minute but not for more than two minutes when the explosion occurred. When running it was customary for the operator to occasionally scrape the portion of the charge, thrown onto and adhering to the sides, into the bottom of the trough in the path of the wheels. This was done by "chasing"—the operator following round for a revolution, behind one of the wheels and pressing a wooden paddle against the side of the mixer, so scooping the mixture to the bottom. The use of a wooden implement, bearing on the wood or hard rubber surface of the mixer has been considered as an adequate safeguard, and has long been the regular practice. Nevertheless if the man were to slip or stumble, as has been known, it is conceivable that a violent blow could be so given on a film of the composition, which at this stage is more sensitive than when the nitroglycerine would be more fully incorporated, as to initiate explosion. Some such inadvertent action, at this stage of the operation, would appear to be the most probable cause of the explosion.

With no previous cause to suspect that any hazard lay in this particular operation one could not condemn it on the ground of the present conjecture. After considerable experimentation and trial, however, the manufacturers have succeeded, by dint of minor adjustments to equipment and changes in the procedure followed in adding the ingredients, in obtaining a well incorporated charge without having recourse to scraping while mixing is in progress.

(3) The third fatal accident in manufacture occurred at Brownsburg on December 21, in the building used for mixing primer composition. In this building the ingredients were weighed, after which they were taken to another building, connected by a passageway, for mixing in a "jelly-bag" mixer, then brought back to the first building where, on a table other than that used for weighing, a gum arabic solution was added, and the resultant wet composition transferred to glasses and placed in containers for removal. The victim of the explosion was the sole operator, Thomas Caspar Chapman, who had been so employed since 1918 and bore a deservedly high reputation as a careful worker. As the explosion took place at 8.34 a.m., about one hour after he had commenced work, during which period no one had been in contact with him, it is not possible to determine the stage reached in the operations by consideration of the time elapsed. From the position of his body, however, and the nature of his injuries—chiefly the right hand blown off and the left side penetrated by fragments blown from the weighing table—there was sure indication that he had been engaged at the table on which was deposited the mixed explosives for the addition of the gum arabic solution. Which of the many movements he may then have been making in the course of his work it is impossible to say, except that, his left hand, although cut, being clean, it was improbable that he was actually mixing the solution with the explosive.



His right hand had certainly been in close proximity to, if not in actual contact with, the mixture. The vessel from which the solution was being poured may have fallen on the explosive—but that would be only one of several inadvertent actions which could be conceived as possible. The main explosion certainly occurred at the place where the gum arabic solution would be added to the dry mixture, of which there would be 40 ounces. A hole was blown in the floor immediately below this point. On the weighing table to the left the only explosive would be the small remainder in the containers, originally sufficiently filled by measure to ensure that the actual weight required would be obtainable. Fire immediately followed the explosion and the building was gutted. There was no damage to other buildings.

While it is impossible to ascribe the explosion to any specific cause, it is reasonable to believe that it was brought about when at least some of the explosive was in a dry, and consequently sensitive, state. Consideration was given to the possibility of altering the procedure hitherto followed to permit of more of the process being carried out with the explosive in a wet state. As a result of trials made a process is being developed whereby the dry mixture, on discharge from the jelly bag, is received in a bag immersed in gum arabic solution, and the excess moisture, held by the composition when taken from the solution, removed by a vacuum drier.

Other accidents in factories did not result in serious injury to employees, but in at least one case, that of an explosion in the corning mill at Belœil, the material loss was considerable. This explosion occurred on February 10 at 1.53 p.m., after the mill had been running for 8 minutes. It was followed, at a few seconds interval, by an explosion in the glaze mill undoubtedly caused by projected debris. The buildings were 425 feet apart and each was barricaded on three sides, the open side, in each case, fronting in a direction in which there were no other buildings. It is computed that in the corning mill there were about 2,200 pounds of sporting powder in the hopper and mill, and 500 pounds of corned powder in bags. In the glaze mill were 1,400 pounds in one drum and 400 pounds in bags. The buildings and equipment were totally demolished. The barricades, badly damaged, served to confine most of the debris and limit the affected area, although some debris, notably pieces of equipment from the higher parts of the buildings, was projected to about 150 yards. No evidence could be found which would point to the cause of explosion. Foreign material in the powder has certainly, and with good reason, been held accountable for many corning mill explosions but this hazard has been very greatly reduced by the preventative devices included in the most modern equipment. An alternative theory, and one which at least may be considered, with profit, in reference to the construction of danger buildings generally, is that the foundation may have shifted, due to frost action, and led to the overheating of a bearing or the breaking of a shaft. Such has been known to happen, and, in this particular case, the weather prior to the accident was favourable to frost action, also the mill was built when the foundation piers were not, as now, provided with footings.

A second corning mill explosion occurred at the James Island factory on February 18, at 8.46 a.m. It was determined that the mill had been

running for approximately 25 to 30 seconds when the automatic cut off operated and the warning siren sounded. About 5 to 7 seconds later an employee, outside, observed a flash about the upper rolls. The main explosion followed immediately. Evidently the powder was ignited in the rolls and flashed down the conveyer to the hopper which, at this stage, would still contain nearly all the powder. About 2,000 pounds of black powder were involved in the explosion which wrecked the building and damaged the equipment, much of which, however, was repairable. Most of the debris lay within 20 feet of the building, but pieces were also scattered up to a distance of 200 feet. The damage to other buildings was practically confined to a few broken windows. The cause of the explosion was not determined. The presence of foreign material was suspected, but there was no clear evidence in support of this.

An explosion occurred in a detonator charging press at the factory of the Canadian Industries Ltd., at Brownsburg on January 23. The operator is fully protected when charging. The window panes in front were broken and slight damage done to the apparatus. The explosive involved was about 11 ounces of lead azide and lead styphnate mixture. The pressed charges of tetryl in the 200 detonators, about to be charged, did not explode. It is unnecessary to describe the operation. At the time of the explosion the hopper, carrying the explosive, was being drawn back over the rubber charging plate. Examination of like plates showed distinct signs of wear caused by the friction of the hopper supports, to and fro, and in one a small particle of steel originally under the surface but exposed by wear. There is little doubt but that the explosion was due to friction of the hopper on particles of powder on the charger plate. The bearing parts of the hopper have now been altered to completely bridge over the powder-carrying portion of the plate with the rubber ridges fixed thereon to confine the powder.

An experimental batch of 22 electric detonators exploded accidentally when about to be tested by an assistant foreman in an electric testing room at the same factory on February 11. The injuries to the operator were fortunately slight, being confined to minor cuts on face and one hand. He stated that the explosion occurred when he was drawing one forward on the bench preparatory to test. It is possible that in so doing the wires slipped under the testing machine, but a thorough trial of the effects of any contacts which could so, conceivably, be made, gave negative results. The possibility of explosion having been brought about by a blow of the detonators on the table was suspected. The tables have been furnished with thick rubber mats and the seating of the instruments on the tables so adjusted as to prevent the passage of a wire under them.

On April 16 an employee of the Macdonald Metal Products Company Ltd., Waterloo, Que., sustained burns from the flashing of 25 sheets of caps for toy pistols at the moment when she was placing them on a bench for examination. Among the defective work picked out at this stage are sheets which are found not to have their upper and lower surfaces properly adhering, so failing to confine each small cap charge in place and permitting the composition to work loose between the sheets. It is probable that the ignition was caused by friction on the composition in one such sheet in the batch.



The explosion of a cylindrical steel tank, 8 feet in diameter and made of  $\frac{1}{4}$ -inch plate, which was being removed for sale as scrap, caused considerable alarm, also damage to a nearby building but fortunately the workmen engaged in its removal were not affected other than by temporary shock. The tank had not been in use since the war period when, at Nobel, it had been used, normally at least, as a solvent storage tank. The rivets securing the bottom to the side, and those along a diameter of the bottom joining the two sections of the bottom, were all sheared, pointing to the presence of an occluded high explosive as nitroglycerine or guncotton between the plates and undetected by previous examination.

### MAGAZINES

The number of magazines under licence at the end of the year was 348 and, additional to these, 236 temporary magazine licences had been issued during the year.

Following on the condemnation of explosives found in an unusable condition, 350 pounds of black powders, 5,100 pounds of dynamite and 355 detonators, distributed over 21 magazines were destroyed. In addition 290 cases of deteriorated explosives were destroyed when a magazine, previously used in connexion with large operations, was being evacuated. Another lot of 100 cases of old explosives, held for several years without occasion for use arising, was also destroyed.

One magazine was caught in a bush fire but time permitted of the removal of the explosives. A second small magazine was destroyed in the same way but there were no explosives stored in it at the time.

An abandoned mine magazine, believed to contain about 800 pounds of blasting powder, was accidentally set on fire by a party of three hunters all of whom were injured by the explosion.

Breaking into magazines has been of more frequent occurrence than usual. Explosives were stolen from 15 magazines so forcibly entered. One of these was a magazine used in connexion with road construction work. From it 57 cases were removed. In another instance a dealer had just taken in 21 cases. These were stolen, but 20 recovered, and the thief detected and convicted. From the other magazines there were stolen, in all,  $28\frac{1}{2}$  cases of dynamite, of which 6 cases were recovered, 1,473 detonators and 200 feet of safety fuse. With the exceptions of the magazine from which the large quantity was taken, and two others, these magazines were substantial permanent magazines operated by dealers. Their necessarily isolated locations render them open to attack and while, given opportunity, none could be made proof against the expert house breaker, yet if the general objection to mortice locks, arising from difficulty in operation under winter conditions, could be overcome, there is little doubt but that strong mortice locks would offer greater security than that given by steel bars secured by the heaviest of padlocks.

The value of the explosives stolen is rarely of much consequence; a more serious consideration is the possibility that the object of some of the thefts is to obtain explosives for unlawful purposes.

The increased activity in road construction work, as a measure of unemployment relief, has called for a more than usually wide distribution

of explosives to temporary magazines operated by Provincial Government departments. The licences issued to cover such storage have been so framed as to allow liberty of action to engineers in charge of districts, to meet the changing conditions as the operations progress, subject to the observation of terms applicable to all cases. In the larger undertakings suitable instructions have been issued by district engineers for the guidance of camp superintendents, and, by co-operation between the staffs of provincial departments, inspectors of the Division and deputy inspectors of the Royal Canadian Mounted Police, endeavour is being made to advise those concerned in the safe keeping of explosives. The inspections already carried out have shown good provision to have been made for the storage of explosives, and a pleasing feature of this work has been the readiness with which recommendations have been received.

Inspectors of the Division made 404 visits of inspection to magazines, and 210 were made by deputy inspectors of the Royal Canadian Mounted Police.

### EXPLOSIVES FOUND

Mining or prospecting parties, on abandoning operations, are prone to leave explosives in a magazine or cache, instead of removing or destroying them. The cost of removal would generally be out of all proportion to the value of the explosives, and it may be presumed that destruction is delayed in the expectation of a resumption of operations in the following year. Even so, the leaving of explosives unguarded for a long period is scarcely justifiable, and when the expectation of return does not materialize, and no further action is taken by the owners, the abandoned explosives become a menace to the public even in the most sparsely inhabited regions. Sometimes such caches are found by chance, and sometimes are traced by the Royal Canadian Mounted Police.

In this way the police located, in the Northwest Territories, an abandoned magazine containing 400 pounds of badly deteriorated dynamite. The original owners, not resident in Canada, were traced. The magazine had been abandoned for about 10 years. The destruction of the explosives was successfully carried out by a police winter patrol.

Another cache of 100 pounds of explosives left in the Northwest Territories by a mining company several years ago was destroyed by the police.

In an old settled part of the country about 200 pounds of old dynamite, loose, was found, by a passerby, in the bush near to a highway. A few years previously the construction of this highway had necessitated the removal of a quarry magazine. The owner had instructed his powder man to destroy about four cases of the dynamite which had exuded. Instead of doing so he had apparently only thrown out the contents and lightly covered them in the bush.

Nine other cases of the finding of explosives, to a total amount of about 185 pounds of dynamite and 75 detonators, were reported, as well as some instances of the finding of explosives which were involved in accidents recorded elsewhere. They were brought to notice in diverse ways: by boy scouts playing near an abandoned mine; on a police search which disclosed dynamite and detonators cached on the rafters of a barn; on boys discovering in an old gravel pit, an ice cream freezer filled with



explosives; when children uncovered some sixty pounds of dynamite near an old oil well derrick; two old dynamite cartridges found among the rubbish in a city yard; while four instances are recorded of the finding of abandoned explosives by new tenants in or near their houses.

In addition, the police found 1,000 pistol cartridges while conducting a search, and five railway torpedoes were found by a new tenant in his garage and handed over to the railway.

### UNLICENSED PREMISES

The term "unlicensed premises" applies to merchants' stores in which are kept sporting cartridges and explosives in small quantities, the keeping of which is subject to the general regulations but does not call for the maintenance of a licensed magazine. It also embraces the places where similar small quantities may be held by work parties or private users of explosives, but, while transient work parties are inspected when practicable, the 669 visits made by inspectors of the Division, and the 2,256 by deputy inspectors of the Royal Canadian Mounted Police, were, in the main, to the permanent premises of merchants. Difficulty is now seldom experienced in their regard. Nevertheless, the rounds of inspection must be repeated both for the instruction of new dealers, and to check the tendency of some others to fall short of established practice on the assumption that the lapse of a considerable period since last inspection indicated that the regulations were no longer in force.

The proper keeping and handling of explosives by merchants is a safeguard against accidents befalling the storekeeper, his assistants, and the public visiting the premises. It is also of direct interest to the Fire Departments. Certainly there has, for a long time, been a freedom from accidents attributable to any remissness on their part, which is to the credit of the merchants engaged in the sale of explosives.

The same, unfortunately, cannot be said in respect to others who have occasion to handle explosives in small quantities. Besides the small transient work-parties already referred to, there are those who require to take a case or so of explosives, from a temporary magazine, for use at the place of work, and who do not always take every reasonable precaution against the loss of explosives; but probably most noticeable of all in neglect to safeguard explosives, is the private user. Although the source from which explosives involved in accidents cannot be always ascertained with surety, yet a reference to the detail of accidents occurring when playing with explosives, as given in Appendix D, will suffice to show what is often the sequel to failure on the part of the private user to lock up explosives. Improvement can be looked for here only by the inculcation of a better understanding of the attendant dangers, and the simple, necessary safeguards; but which, with the willing aid as given by the Royal Canadian Mounted Police, schools, safety leagues, and the press, may yet be accomplished.

### IMPORTATIONS

The quantities of explosives, of the several classes, imported during the year are given in Appendix C. These importations were made under the authority of 461 permits and 42 special permits.

Approximately 3 per cent of Chinese fireworks presented for importation was rejected following on examination made either in Ottawa or by the Dominion Analyst at Vancouver. All consignments imported through Victoria and Vancouver are held for examination at Vancouver, where the work is carried out with most gratifying despatch. The deputy inspectors of the Royal Canadian Mounted Police, co-operating with the Customs officers, obtain a representative selection of samples, transmit these to the laboratory for chemical determinations and report also on any noteworthy features relating to the functioning of the fireworks.

The explosives, other than fireworks, which are imported consist mainly of those required for use in explosives factories and for other manufacturing purposes. The most important exception to this, although not strikingly so in quantity, is the importation of nitroglycerine to the oil fields in Alberta and Ontario. The supervision over this traffic requires advance intimation being given to the Customs and police officers at the port of entry, examination by the deputy inspector of explosives of the Royal Canadian Mounted Police of the vehicles used, the giving of directions by him of route to be followed and his notification to other officers of expected time of arrival at destination or other points, whilst, in Ontario, he escorts the truck to destination and ensures the proper disposal of the explosives if there is any delay before use. Finally, if any explosives are left over, and no magazine is available for their storage, he supervises their exportation. As these importations have often to be effected on short notice, and arrangements made by telegraph, the fact that the Royal Canadian Mounted Police have always found means to render this responsible service is one which should not pass unnoticed. The control exercised is necessary in the interests of the public safety, but it is hoped that the importers concerned will appreciate the efforts made to expedite the delivery of their explosives, and reciprocate by giving, whenever possible, timely notice of their requirements, and by ensuring that all will be in readiness for using the explosives on receipt.

### **AUTHORIZATION OF EXPLOSIVES**

An addition of eight explosives was made to the authorized list and changes in the formulæ of two others authorized after examination. Three explosives presented for authorization were refused.

Eight explosives, no longer being made, were withdrawn from the list on the application of the manufacturers. Six new varieties of fireworks were submitted, four being authorized.

Check examination was made of 259 samples of fireworks presented for importation. Of these 40 were rejected as not being in accordance with the terms of the importation permits.

### **PROSECUTIONS**

A contractor was convicted on a charge of violation of the terms of a temporary magazine licence, he having placed his magazine nearer to a railway than the distance prescribed. Another was found guilty of having in his possession a larger quantity of explosives than may lawfully be kept elsewhere than in a licensed magazine, and of storing dynamite and detonators together.



Three merchants and two private users of explosives were convicted on charges of keeping small quantities of explosives otherwise than in locked receptacles as required by the regulations; two other merchants on charges of failing to keep records of receipts and issues of explosives or rifle or pistol cartridges, and one carrier for breach of the conveyance regulations.

Fines were imposed in all cases.

### ACCIDENTS

A marked reduction has been observed in the number of fatalities caused by accidents in the use of explosives, of which 9 occurred in mines and quarries and 23 in the conduct of operations elsewhere. This represents a diminution, particularly in respect to mines and quarries for which the average figure for the five preceding years was 20·6. The average number of fatalities in other operations was 26·4, excluding from consideration the abnormal loss of life occasioned by the Brockville disaster of 1930. The number of persons who sustained injuries in mines was 67, slightly above the average figure of 60, but the number injured in other classes of work showed a considerable increase, from an average of 100 to 167. It is, however, probable that the efforts made to collect information of accidents, other than those which are included in returns to Dominion or Provincial Government departments, are meeting with greater success.

A summary of the accidents, classified according to their probable causes, is given in Appendix D. Those due to playing with detonators and other explosives are also given in more detail. Four lives were lost and 46 persons, nearly all children or young lads, were injured as a result of playing with explosives. This annual loss, both in life and in the maiming of the young, does not yet show that abatement which it is hoped may be secured by constant educational effort and the publicity given to the distressing consequences of such accidents.

Accidents in the use of explosives, attributable to projected debris, failing to take proper cover, returning to investigate a presumed misfire, boring into unexploded charges, and other well known causes, may, to some extent, be regarded as inevitable, but many are undoubtedly due to the taking of unnecessary chances. Contributory causes, often overlooked by men otherwise careful, lie in the use of uncovered cases or boxes for holding explosives when preparing charges at the shot hole, and in the caching of explosives near the place of use. The latter may be the prelude to accidents to boys who have been able to take some of the explosives, and sometimes too the less guilty may suffer, as when two lads, firing at a tree stump in the woods exploded a case of dynamite cached at its base. The danger of having explosives uncovered at the shot hole may be exemplified by the explosion of detonators in an open tin, brought about when lighting the fuse, which severely injured two men. In another case two men were injured by an explosion which occurred when they were preparing charges in a shack, in which was a stove and alongside of this an open case with the detonators and dynamite. An even more striking case was that of the unfortunate man who, lighting the fuse before inserting the charge, shielded it, from the wind, by holding it in the shelter

of an open box of explosives. In fact although most accidents arise from the hazards, whether avoidable or not, commonly associated with blasting operations, the circumstances attending others often bring to notice unusual, or unsuspected causes. A hot bolt or other piece of metal, hastily thrown from a forge on a drill boat in the dark, is believed to have alighted upon explosives in a scow alongside. Fire broke out soon followed by explosion but, fortunately, after an interval sufficient to allow the men to escape without serious injury. A farmer, setting out to do some land clearing, took with him his three young children and a lad of 18 years of age. This youth, with no previous experience of explosives, experimented, in the temporary absence of the farmer, by igniting a stick of stumping powder. The remainder of the explosives took fire and did not explode but all three children were badly burned. Two men sustained minor injuries when investigating a misfire. They had forgotten to disconnect the firing battery, and, when looking for a break in the circuit, made contact between the broken ends of a lead within the insulating covering. A unique accident, and certainly one which the victim could not have prevented, befell a workman who was cutting a hole in the concrete floor of a building. A detonator, wholly embedded in the cement exploded and injured him in the face and on his hands. A piece of burned fuse was also found. The accidental inclusion of a detonator with the stone from a quarry is understandable, but how it could find its way unexploded and undetected, through crushing and other processes until buried in a concrete floor, is extraordinary. Such an accident is outside the realm of accidents in use. These are happily fewer this year. The insistence by employers on the taking of reasonable precautions undoubtedly has a good effect in limiting the accidents in shot firing. A more general appreciation on the part of the occasional users of explosives—among whom are numbered most of the sufferers—of the need of taking similar precautions, would surely lead to fewer casualties.

From the table given in Appendix D it will be noted that playing with explosives was responsible for 3 deaths and injuries to 50 persons, which closely approximates to the corresponding figures for the two preceding years: 2 and 51 in 1929 and 3 and 54 in 1930. It is true that the proportion of deaths to injuries is lower in this class of accident than in the normal use of explosives, still the consideration that for every 3 men killed or injured in the course of blasting operations one person, usually a child, is the victim of mere playing with explosives, and this without taking count of the accidents classed as "various," most of which are traceable to a like primary cause, points to too common a failure to appreciate the necessity of so safeguarding explosives that they may be neither lost, forgotten, nor pilfered.



## APPENDIX A

## Factories Licensed to Manufacture Explosives in 1931

Owner	Location of factory	General nature of product	Remarks
Canadian Industries Ltd.....	Belœil, P.Q.....	Blasting explosives, black powders, propellants.	
Canadian Industries Ltd.....	James Island, B.C..	Blasting explosives, black powders.	
Canadian Industries Ltd.....	Nobel, Ont.....	Blasting explosives.	
Canadian Industries Ltd.....	Brownsburg, P.Q....	Ammunition, detonators, etc.	
North Star Explosives Co. Ltd.	Prescott, Ont.....	Fulminate of mercury...	Operation intermittent.
Canadian Safety Fuse Co.....	Brownsburg, P.Q....	Safety fuse.	
T. W. Hand Fireworks Co..	Dixie, Ont.....	Fireworks.	
Toronto Fireworks Co.....	Islington, Ont.....	Fireworks.	
B. Marroni.....	Ville St. Pierre, P.Q.....	Fireworks.....	Operation intermittent.
MacDonald Metal Products Co.	Waterloo, P.Q.....	Toy pistol caps.	

## APPENDIX B

## Production of Explosives in Canadian Factories during the Year 1931

	Quantity
Class I. Gunpowder.....	229,392 lbs.
" II. Nitrate mixtures.....	724,000 "
" III. Nitro-compounds—	
Division 1.....	40,730,467 "
" V. Fulminates—	
Division 1.....	62,945 "
" VI. *Ammunition—	
Division 1—	
Safety cartridges.....	89,359,356 "
Safety fuse.....	Output of one factory.
Railway torpedoes.....	Output of one factory.
Percussion caps.....	Output of one factory.
Division 3—	
Detonators and electric detonators.....	Output of one factory.
" VII. Fireworks—	
Division 2.....	(approx.) \$149,000

\* Exclusive of artillery ammunition but includes small arms ammunition made in Government factories.

## APPENDIX C

## Explosives Imported into Canada January 1 to December 31, 1931

Class	Division	Description	Quantity
I		Gunpowder.....	277 lb.
II		Nitrate mixtures.....	545 "
III	1	Mixtures containing liquid nitro-compounds.....	39,741 "
	2	Nitro-compounds:—	
		(a) Propellants.....	100,496 "
		(b) For use in explosives factories.....	121,935 "
		(c) For other manufacturing purposes.....	631,212 "
V	1	Fulminates.....	14,000 "
VI	1	Percussion caps.....	21,000 "
		Safety fuse.....	100,000 ft.
	2	Delay elements.....	369,000
		Miner's squibs.....	1,500
		Detonating fuse.....	264,037 ft.
	3	Detonators and electric detonators.....	150
VII	2	Manufactured fireworks.....	450,540 lb.



# **APPENDIX D** **Accidents from Explosives during the Calendar Year 1931**

Circumstances or Cause	In Mines and Quarries			Elsewhere			Total	
	Number of			Number of			Number of	
	Accidents	Killed	Injured	Accidents	Killed	Injured	Accidents	Injured
I. Manufacture*								
II. Keeping.....				9	6	2	9	6
III. Conveyance (other than by railway).....								
Total, Manufacture, Keeping, Conveyance.....				9†	6	2	9	2
IV. Use and Miscellaneous—								
Shot Firing—								
(a) Prematures, and failing to get away from shot hole.....	6		7	6	3	5	12	12
(b) Firing by electricity when persons are at the shot hole.....	2		3	1		1	3	4
(c) Not taking proper cover.....	10	2	8	12	2	10	22	18
(d) Projected debris.....	7	1	7	24	3	25	31	32
(e) Hangfires, and returning too soon to shot hole.....	3	1	2	7	2	5	10	7
(f) Tampering with misfired shots.....								
(g) Ramming or stemming the charge.....	1		1	1		1	2	2
(h) Sparks, flame, etc.....	2		2	5	1	8	7	10
(i) Boring into unexploded charges.....	6	3	8	3	1	3	9	11
(j) Striking unexploded charge in removing debris.....	1		2	1		1	2	3
(k) Preparing charge.....	1		1	2	1	1	3	2
(l) Lighting fuse before inserting charge.....	1		2	1		3	2	5
(m) Fumes.....	5	2	14	1	1		6	14
Various.....	5		5	11	4	8	6	13
†Miscellaneous—								
(a) Playing with detonators.....	1		1	23	3	31	24	32
(b) Playing with other explosives.....				14		18	14	18
(c) Various.....	2		4	10	2	19	12	23
Total Use and Miscellaneous.....	53	9	67	122	23	139	175	206
Total all Circumstances.....	53	9	67	131	29	141	184	208

\*Circumstances are given in text of report.

†Circumstances are given on next page.

‡ Except for these the accidents given in this table occurred in circumstances not directly controlled by the Act.

## APPENDIX D

## Playing with Detonators

Cause of Accident	Killed	Injured
Boy found a detonator in his father's tool box. Not knowing its properties he tapped it with pliers. It exploded. His right hand was shattered and had to be amputated.....		1
Boy, age 13, playing with a cigar lighter and a detonator exploded the latter. He lost an eye.....		1
Boy, age 10, found box of detonators in a neighbouring barn. He let them fall on kitchen floor. The explosion shattered several fingers of his right hand and severely injured his mother, who was standing nearby.....		2
Boy, age 17, took detonator from neighbour's barn, fused it and applied a light to the fuse. His hands were injured by projected fragments of metal.....		1
Boy, age 5, exploded a detonator with which he was playing. His father had been blasting stumps on his farm and the child, unnoticed, had evidently obtained possession of a detonator. His hand was injured.....		1
Two boys, ages 9 and 13, were given detonators by a companion who found them in a yard. While playing with them they exploded, injuring both boys.....		2
Boy, age 6, found a detonator on the highway. He placed it on a stone and struck it with another. He lost three fingers of left hand and suffered other minor injuries.....		1
Boy, age 11, found a detonator, and exploded it by hitting it with a stone. He lost two fingers and thumb of left hand and first finger of right hand. His young sister, age 7, standing near, received minor injuries.....		2
Boy exploded a detonator when playing with it near a stove. Two fingers and thumb were blown off.....		1
Boy, age 10, found a detonator in a neighbour's stable to which he was in the habit of going, to take the cow to pasture. The boy picked the composition with a nail. It exploded and he lost thumb and part of first finger of right hand.....		1
Boy, age 8, found a detonator near a logging camp. It exploded while he was playing with it. He lost two fingers and thumb of left hand.....		1
Boy, age 11, found a detonator which exploded while he was playing with it. He lost one finger and suffered injuries to face and chest.....		1
Boy, age 6, was fatally injured by the explosion of a box of detonators which he was trying to hammer open.....	1	
Party of picnickers broke into a locked cabin on a farm and attempted to open a box found therein, containing detonators and possibly other explosives. An explosion occurred. Two men were killed and five women seriously injured.....	2	5
Boy, age 13, entered shack in which scrap detonators had been placed. He took a few and, while playing, one exploded. He lost a thumb and his face was mutilated.....		1
Man found detonators in shack he had rented. He picked the composition of one with a pin. It exploded. He lost one eye, thumb and two fingers of left hand.....		1
Boy, age 10, found detonators in shed of house left by a former tenant. He tried to remove composition from one. It exploded. His left hand was shattered necessitating amputation.....		1
Boy, age 10, found detonator in milk house on his father's farm, and while playing with it, it exploded. He had two fingers badly injured.....		1
Boy, age 7, with companions, entered a shed and found detonators. He exploded one by applying a light to it. He lost part of a thumb and two fingers and received cuts on face.....		1
Two brothers, ages 11 and 12, found a detonator while visiting the house of a contractor. The elder boy applied a match to one. It exploded. He lost three fingers, and his brother received minor injuries to hands and face.....		2



APPENDIX D—*Continued*

## Various

Cause of Accident	Killed	Injured
Boy attempted to break detonator with his teeth, being unsuccessful he applied a match to it. It exploded and he lost two fingers.....		1
Miner returning capped fuses to cap house retained one and lit fuse to watch it burn. The detonator exploded. He lost first finger and thumb of left hand.....		1
Boys entered an unlocked shack and found a box of detonators. One boy tried to open it by striking it on the pavement. In the explosion his right hand was shattered, necessitating amputation. His younger brother received minor injuries.....		2
Boy, age 9, found a detonator in pocket of an old vest of his father. He tapped it on the stove and it exploded. He lost two fingers and thumb of right hand.....		1
	3	32

## APPENDIX D—Continued

## Various

Cause of Accident	Killed	Injured
<i>Powders—</i>		
Youth placed a half filled bottle of gunpowder in snow bank and enticed a young boy to the scene. As the boy picked up the bottle the youth threw a lighted match into the bottle. The powder exploded injuring the boy's face and hands.....		1
Three boys found a cache of gunpowder. One boy ignited the powder. By the explosion he lost his eyesight. The other two received minor injuries.....		3
Boy, age 7, found some gunpowder and was shaking it on to a fire when an explosion occurred. He received severe wounds in the stomach..		1
<i>Ammunition—</i>		
Boy found .22 R.F. cartridge and exploded it by throwing it against a wall. A fragment penetrated his leg.....		1
Boy placed a cartridge on street car tracks. A passing car exploded it. The projected metal struck a 6 year old child, wounding him on the arm.....		1
Boy found rifle cartridges, belonging to his father, and exploded several by striking the primers with a stone. A companion standing near received a fragment in the leg.....		1
<i>Dynamite—</i>		
Man set off several sticks of dynamite successfully. He then tried a group of 4 sticks. Three fired, the fourth missed. He jumped on the missed shot and it then exploded. All toes were blown off one foot and some off the other. He received injuries to legs and body.....		1
<i>Fireworks—</i>		
Boy, age 14, placed a mixture of chlorate, sulphur and sugar in lead pipe, to make a rocket for his hand truck. While closing one end of pipe with a hammer there was an explosion. His hand was badly shattered, one finger being blown off.....		1
Two cases are recorded of boys, ages 7 and 10, having their eyes injured by the explosion of fire crackers held in their hands.....		2
Boy, age 8, ignited a firecracker in his trouser pocket. He was badly burned.....		1
Two boys, ages 11 and 12, found a salute bomb, used for display purposes, on exhibition ground. They tried to open it with an axe. It exploded, both boys were severely injured.....		2
Fireworks in shop display were fired, evidently mischievously by a boy. The shop window was blown out. No one was injured.		
A farmer, his brother, and hired man drove to field to do stumping. They had a case of explosives on the wagon. The farmer's children also accompanied them. The brother (18) was left in charge of the wagon and children. Not knowing the nature of explosives he applied a light to some powder. The whole case was ignited. The three children were all seriously burned.....		3
		18



APPENDIX D—*Concluded*

## Various

Cause of Accident	Killed	Injured
A Japanese, firing fireworks in New Year's celebration, was badly injured by the explosion of a bomb. He lost one eye and his hearing was destroyed.....		1
A woman, not knowing its nature, threw a package of gunpowder into stove. She was burned about hands and face by the explosion.....		1
Using chips gathered from the floor, a man started a fire in stove of abandoned farm house. While warming his hands an explosion took place. He was badly cut about arms and his hands injured. On further search of floor detonators were found.....		1
Man found detonator tin in a river bed and meant to use it as a receptacle for gold dust. He left it in the sun to dry and, on trying to open it later, it exploded. Both hands and eyes were injured.....		1
During a fireworks display a mortar, although pitted, tipped on discharge and the "bomb" fired into the crowd which the police had great difficulty in keeping at a safe distance. Nine persons were injured chiefly by burns.....		9
A detonator which was in an office drawer, unknown to any of the staff, exploded when a man was cleaning out the drawer. He received injuries to thumb and two fingers of left hand and to his right eye.....		1
Boy, age 14, built a fire on which to roast potatoes. While leaning over it he was injured in eye and burned by projected fragments. Probably a cartridge or detonator had been gathered up with rubbish thrown on fire.....		1
Two lads, trying out a rifle, used as a target a stump behind which had been cached 2½ cases dynamite and detonators, belonging to a road gang. There was an explosion. Both lads were injured.....		2
Woman, thawing pipes in her cellar, ignited some detonators stored there unknown to her. She died from injuries.....	1	
Man took two sticks of dynamite from a construction camp, and with two companions went to a lake evidently intending to dynamite fish. He prepared a charge and lit the fuse, but the charge exploded in his hand. He died from injuries and his two companions received lacerations to body and suffered severe shock.....	1	2
While preparing charges a miner dropped a detonator and evidently stepped on it. While trying to open the mouth of the detonator, which had been closed, it exploded. His fingers were lacerated.....		1
Three hunters were injured by the firing, followed by an explosion, of an abandoned mine magazine to which they apparently set fire accidentally.....		3
	2	23

## APPENDIX E

## Authorized Explosives

Explosives manufactured by Canadian firms as hereunder detailed:—

Burrowite Explosives Ltd.

Burrowites Nos. 1, 2, and 3.

Canadian Industries Ltd.

Polar dynamite—25, 30, 35, 40, 50, and 60 per cent and 50 per cent special.

Polar dynamite, mining—35, 40 per cent.

Polar ammonia dynamite—20, 25, 30, 35, 40, 50, 60 per cent and "F."

Polar ammonia dynamite, mining—20, 25, 30, 35, 40, 50, 55, and 60 per cent.

Polar gelatinized dynamite—50, 60, 65, 70, and 75 per cent.

Polar forceite gelatin—30 35, 40, 50, 60, 75, 80, and 90 per cent.

Polar forceite gelatin—Diamond—30, 35, 40, 50, 60, 75, 80, and 90 per cent.

Polar gelatin dynamite—30, 35, 40, 50, 60, 75 and 80 per cent.

Special dynamites—No. 1.

Coal mining explosives.

Polar Monobel Nos. 4 6, 7, and 12.

Polar CXL-ite No. 2.

Polar stumping powders No. 1 and extra and "Blastol."

S.N.G.

Safety fuse lighters.

Signal bombs.

Cordite.

Black blasting powders.

Blackpowder pellets.

Gunpowder.

Sporting powders.

Safety fuse powder.

Canadian Safety Fuse Co., Ltd.

Safety fuse—"Clover" brand.

Safety fuse—"Black Clover" brand.

Safety fuse—"Beaver" brand.

Safety fuse—"White Jacket" brand.

Safety fuse—"Crown" brand.

Safety fuse—"Moose" brand.

Dominion Cartridge Co., Ltd.

Ammunition.

Detonators.

Lead Azide.

Lead Trinitroresorcinate.

Percussion caps.

Railway torpedoes.

Electric detonators.

Railway fuses.

Mexco Ltd.

Klorex, Nos. 1 and 2.

North Star Explosives Co., Ltd.

Fulminate of mercury.

All explosives on the British authorized list are provisionally authorized in Canada, and in addition, those manufactured by the following firms, as detailed below:—

Aetna Explosives Co., Inc.

Standard dynamite L.F.—15, 20, 25, 27, 30, 33, 35, 40, 45, 50, and 60 per cent.

Straight dynamite—15, 20, 25, 27, 30, 33, 35, 40, 45, 50, and 60 per cent.

Keystone standard gelatin—40, 60, and 75 per cent.

Stumping powders—20 and 30 per cent.



APPENDIX E—*Continued*

American Glycerine Co.  
Nitroglycerine.

American Powder Co.  
American R.C. 22 short.

Atlas Powder Co.  
Electric blasting caps, Nos. 6, 7, and 8.  
Blasting caps, Nos. 6, 7 and 8.  
Nitrocellulose.  
Trinitrotoluene.

Brücker and Zinke.  
Safety fuse—"Globe" brand.

Brücker and Zehetzsche.  
Safety fuse—Black fuse "Triumph" brand.  
White fuse "Triumph" brand.

California Cap Co.  
Detonators.

Dumore National Chemical Co.  
Regina stumping powder Nos. 1 and 2.  
Regina rock powder Nos. 1 and 2.

E. I. Dupont de Nemours & Company, Inc.  
Dupont bulk rifle powders (Nos. 80, 90, 91, 92) Rifle No. 1 Schuetzen.  
Dupont smokeless shotgun powder.  
Dupont pistol powders Nos. 3 and 5.  
Dupont sporting rifle powders Nos. 95, 96, and 93.  
Dupont military rifle powders (M.R. No. 20-23) (Nos. 10, 21, 22, 30, 40, and 50).  
Dupont gallery rifle powder No. 75.  
Dupont Schultze smokeless shotgun powder.  
Ballistite smokeless shotgun powder.  
Improved military rifle powders Nos. 13, 15, 15½, 16, 17, 17½, 18, 23, 25, and 25½.  
Dupont dense smokeless shotgun powder.  
Fulminate of mercury.  
Guncotton.  
Trinitrotoluene.  
Dynamite and blasting gelatin.  
Agritol.

Ensign-Bickford Co.  
Cordeau-Bickford fuse.

Hercules Powder Co.  
Bullseye revolver powder.  
Infallible smokeless shotgun powder.  
Dynamite and blasting gelatin.

Illinois Powder Manufacturing Co.  
Ammonia dynamite—40 and 60 per cent.  
Powertol No. 1 and No. 3.

Independent Torpedo Co.  
Nitroglycerine.

Puget Sound and Alaska Powder Co.  
Gelatin dynamite—25, 30, 35, 40, and 60 per cent.  
Dynamite, L.F.—20, 30, 40, and 60 per cent.  
Special gelatin—25, 30, 40, and 60 per cent.  
Straight gelatin—25, 30, 40, and 60 per cent.  
Special stumping dynamite.  
Special stumping dynamite—20 and 30 per cent.  
Special dynamite—40 and 60 per cent.  
Straight dynamite—40 and 60 per cent.

APPENDIX E—*Concluded*

Trojan Powder Co.  
 Trojan Blasting CC.  
 Trojan TL 502.  
 Trojan 35 per cent standard.

United Railway Signal Corporation.  
 Railway torpedoes.

Western Cartridge Co.  
 Detonators.

Fireworks as manufactured by the following Canadian makers, namely:—

T. W. Hand Co., Ltd.  
 Toronto Fireworks Co., Ltd.  
 Dominion Fireworks Manufacturing Co.  
 Berardo Marroni.  
 MacDonald Metal Products Company, Ltd.

Certain fireworks manufactured by the following foreign makers, namely:—

Rochester Fireworks Company.  
 M. Backes Sons, Inc.  
 Hitt Fireworks Co., Inc.  
 A. Jedel.  
 Kilgore Manufacturing Co.  
 National Fireworks, Inc.  
 Victory Sparkler Co.  
 Essex Specialty Co.  
 Edwards Co.  
 Federal Buster Corporation.  
 Los Angeles Fireworks Co.  
 Geb. Weinrich.  
 Central Railway Signal Co.  
 Fred. Wicke.  
 Ying Shing Loong.  
 M. Wagner.  
 J. F. Eisfeld.  
 International Fireworks Co.  
 Edmiston Manufacturing Co.  
 Adrian and Rohde.  
 Hamburg-Bremer Handelgesellschaft.  
 A. G. für Anilinfabrikation.  
 Wilhelm Fischer.  
 Potts Fireworks Display Co.  
 Antonelli Fireworks Co.  
 Safety Automatic Toy Co.  
 American Fireworks Co.  
 Blumberg & Co.  
 Standard Railway Fusee Corp.  
 Unexcelled Manufacturing Co., Inc.  
 H. Nicolaus & Co.  
 Continental Fireworks Manufacturing Co.  
 Burke and James Inc.  
 Coston Supply Co.  
 Gerka-Werke.  
 John G. Marshall.  
 Norman Willets Photo Supply Co.  
 New Jersey Flugent Co.

Also Chinese firecrackers with gunpowder composition and not exceeding 4 inches in length and nine-sixteenth inch in diameter and such other varieties the authorization of which has been specially notified to the parties immediately concerned.











